SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, OCTOBER 27, 1905.

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

DeWITT BRISTOL BRACE.

MARKED ability in devising experiments, in minutely observing phenomena, and in correctly interpreting the same, are of themselves sufficient to make a physicist of note. Add mathematical power and, unless circumstances are untoward, our physicist will come to stand among the very few. Such a one was Professor Brace. Nay, he was even more; for with him circumstances were most untoward. The battle was long and arduous before he could build up his department and make his work tell.

When he came to Nebraska the university was poor indeed, the equipment meager. The period when one man taught all the sciences had barely passed. That hither had come a man who could set up his apparatus and spend precious time in investigation was astounding. No wonder the chancellor, who caused to be torn down the shed that sheltered the apparatus, should have thought he did God service.

With the growth of the university came not a parallel growth of the means to carry on the work. The demands of the classroom grew more rather than less exacting. Nor was any work slighted. Those who have served with him on committees know how high were his ideals, how conscientious his purposes, how sane his judgments. Yet for his investigations he was able here and there to snatch a moment; so that, during term time, he was at least able to determine and plan the lines his work should follow during vacation. Gradually he gathered about himself enthusiastic students whom

he trained up as co-workers. Moreover, these would work with him through the vacations. Thus, all last summer, frequently till late at night, one could find, in the old basement laboratory, professors and students immersed in work.

More than once he had attractive calls to the east. Yet, because he felt that on going elsewhere he would have to begin all over again with great loss of time, these calls were refused. Had he known how long he would have to wait for the promised new laboratory; had he known that he was never to work in it: even then, I believe he would have stood by the work he had entered upon here.

In spite of all difficulties he was turning out several papers yearly. This summer he was just able to finish and send to *The Philosophical Magazine* a paper on 'Fizeau's Method in Ether Drift.' This will probably rank with a former paper 'On the Resolution of Light into Circular Components in the Faraday Effect.' In the November number of *The Physical Review* he will have a paper 'On Anomalous Dispersion and Achromatic Systems of Various Types.'

Thus did he work to the very end, 'without haste, yet without rest.' Need it surprise us then that those with him caught his inspiration and that the publications of the department, mostly prepared during vacations, should number some forty or more papers?

When can we Americans learn that 'in universities truly worthy of the name,' place should be made for investigation throughout the year; that those fitted for investigation should be untrammeled, perhaps even encouraged to engage therein. Might it not be better to reserve for vacations solely the command 'thou shalt not investigate'?

But it is something that the laboratory he has done so much to create may be named in his honor; and it is more that the band of devoted workers he had gathered about him will therein have the opportunity, as they have the absorbing purpose, to carry to complete and perfect fruition his pregnant ideas.

Cut short in the beginning of his triumphs he will, nevertheless, be ranked among our physicists along with Gibbs and Rowland.

ELLERY W. DAVIS.
THE UNIVERSITY OF NEBRASKA.

EDUCATIONAL PROBLEMS AT YALE UNIVERSITY.[1]

THE recent history of our large universities shows the growing importance of providing land for museums and bureaus of research.

A university has to deal with two classes of problems—those which arise out of its relations to its students, and those which arise out of its relations to the general public. Most discussions of university work concern themselves chiefly with the relations of the institution to the student body. We try to arrange a course which shall meet the needs of the students; we organize the work of the professors with the same end in view. Three quarters of the time of the corporation and more than nine tenths of the time of the faculties is occupied with the consideration of problems involving the welfare of the students primarily or exclusively.

But this is not the whole work of a university. It must care for its students in this way; but it must do something far more than this. Its relations to the general public are, I believe, quite as important as its relations to its students. It is something more than a large school or group of schools. Its professors can be occupied with something better than the discussion of student discipline. The noble definition

[1] From the annual report of President Hadley.

of President Wilson, that a university is a place where many are trained to the love of science and letters and a few to their successful pursuit, may, I think, be given a broader application than its author had in mind. A university should be a place which promotes the love of science and letters and the understanding of the liberal arts not only among the few thousands who may happen to be its pupils, but among the many thousands with whom it comes less closely in contact. The work of a university is to maintain standards. It can hardly succeed in that work if it confines its inspiration to the relatively small number who have had the good fortune to live within its walls. It must appeal at once to its smaller constituency within its walls and to its much larger possible constituency without them.

Yale men have always recognized this responsibility and have done a great deal of work for the community. But Yale has taken less credit and less advantage from this than it might wisely have done. The relations of this public work to the university have been unnoticed. Its status here was so far undefined that it has been taken out of our hands the moment it has achieved public recognition. I suppose that Yale University may fairly claim to be a starting point of modern scientific agriculture. Certainly the development of agricultural experiment stations, which have proved so important in revolutionizing the practise of our farmers, and have done so much to increase the productivity of our soil, started from Sheffield Scientific School. This movement has extended all over the world. Its cardinal importance in theory and in practise is everywhere recognized. But nobody gives the credit to Yale. We hear of what Wisconsin does for agriculture; we hear of what half a dozen other universities do. Of Yale, we hear chiefly of what she has failed to do. Why? Simply because this whole important movement was in its initial stages carried on so quietly that its importance never properly impressed itself upon our graduates or upon the public; and those universities reaped the benefit which, seeing the real importance of the work Yale was doing, gave it the recognition which we had withheld.

We are in danger of repeating the same kind of error to-day. We are in danger of ignoring the existence and usefulness of some of the things among us which are most important for our public influence. Whenever a reception is held in the galleries of the Yale Art School many men speak with wonder of the fact that they have neglected for years a means of enjoyment and culture which stood ready to their hand. Scarcely one in ten among the Yale students or graduates knows the extraordinary value and interest of our art collections. If our own students do not realize seriously what we have in the way of art treasures and what we might do with them for our own culture, we can hardly expect the outside public to realize it more fully. Our various scientific collections are somewhat better known than our art collections, both to the students and to the public; but even these fall far short of having the usefulness which they might well attain in stimulating scientific interest among the students and throughout the city.

The means which we can use to bring our work more fully into contact with the public may be grouped under five heads:

1. The natural history collections in the Peabody Museum. Of these the most widely known are the fossil vertebrates originally collected by Professor Marsh. Going out as he did at the time when the fossil beds of the Rocky Mountain region were first opened, Professor Marsh had exceptional opportunities for obtaining

material, and in his own particular line of discovery our museum has ranked as the first in the world. Since Mr. Marsh's death his work has been ably carried on, first by Professor Beecher and now by Professor Schuchert. Both of these gentlemen have done a great deal in making the collections accessible to the public; and they would have done a great deal more had they not been handicapped by lack of funds. For the Peabody Museum has practically no endowment for its support, and is dependent upon the small sums which the university can furnish out of its current income. Of scarcely less attraction to the casual visitor are the mineral collections, under the charge of Professor Dana; while we have important material for study both in zoology and in anthropology. It is exceedingly desirable that these different collections should be better known to the citizens of New Haven and their children. A most important connection between university work and public-school work can be made on this line, which would help to give us our proper place in the educational system of the city. The little which has already been done in bringing high school pupils into the museum is proving valuable, both to the children and to us. It is, I hope, only a beginning; an indication of the possibilities which we have before us when we are ready for more organized cooperation with the schools.

2. In the art school we have two unique collections; the Jarves collection of Italian paintings in the north gallery, and the Trumbull collection of early American paintings in the south gallery. The Jarves collection, apart from its value to the student of art history, has a number of pictures of the very first rank, and has been supplemented by others which Mrs. Derby has placed in our charge—so that we can now show excellent specimens of Botticelli, Correggio and other Italian artists of scarcely inferior prominence. Of even more interest to the general public is our collection of modern pictures, of which the Trumbull collection formed the nucleus. Viewed simply from the standpoint of the student of history, the battle pictures by Colonel Trumbull and the contemporary portraits of Washington, Hamilton and other leaders of the American Revolution, are exactly what a university needs to create the right kind of atmosphere within and the right kind of influence outside. No other American university owns art collections approximating ours in value, if we would but avail ourselves of the advantage which they give us. The failure to do this is not the fault of the art school. This school is doing active work in regular classes and evening classes, public lectures and loan exhibitions. It renders us more public service than we appreciate; and it only needs proper recognition in order to make that service many times greater than it is at present.

3. The public work of our music school is somewhat better known. Indeed, this department of the university may serve as an example of what can be done in the way of public service with somewhat small materials, provided men like Professor Parker and Professor Sanford are in charge. With relatively small means at command this school has developed a symphony orchestra which serves at once as a laboratory for the students of music and a means of enjoyment and education to the public. It has repeatedly brought audiences of three thousand people to Woolsey Hall to hear music of the very highest class. Besides these concerts of our own, we have the benefit of visits by great artists from outside; and, what is perhaps still more remarkable, all this part of our university activity has been placed on a self-supporting basis. It has at the same time stimulated an increased interest in the study of

oratorios and choruses among the people of New Haven, under the leadership of various members of our musical faculty. Nor should we fail to mention the importance of the collections given by Mr. Steinert, now housed in the upper floor of Memorial Hall, whose historic importance is parallel to those in our art galleries and museums.

4. Still another development of outside activity is seen in our public lecture courses. These are by no means a new thing. Almost from its very beginning the Sheffield Scientific School has arranged year by year a course of public lectures on scientific subjects under the title 'Lectures to Mechanics.' A few years ago some of the people in New Haven, of their own initiative, organized a 'New Haven University Extension Center,' and arranged for somewhat similar courses of lectures, covering the fields of literature and art as well as science. The advantage of cooperation between the university and the citizens of New Haven was so obvious that we are now working together instead of separately, and by this combination we can keep the grade of the lectures high and at the same time reach a wider range of hearers than would be otherwise possible.

5. The most recent development of our public activity has been connected with the appointment of Dr. Sneath as professor of the theory and practise of education. Professor Sneath's work consists of three distinct parts. He gives regular instruction in his subject; he takes charge of the newly organized summer school; and he arranges means for closer communication and interchange of ideas between Yale and the teachers in various parts of the country. Of the value of his work as an instructor, both to graduate students and to teachers, it is unnecessary to speak. Of his work in organizing the summer school it will be more appropriate to speak in next year's report, when we have a season behind us, than to attempt to prophesy in advance. It will be sufficient for the moment to say that the prospectus of this summer school, issued as a bulletin of Yale University in February, 1905, is a document which every Yale man may read with satisfaction. But, useful as such a summer school may prove, I regard Professor Sneath's work in communicating with the teachers as having even greater importance. At much sacrifice of time and labor, he has made journeys through different parts of the country, especially in the south; and he has at every stage of his journeyings helped us to bring the effect of our Yale life and Yale standards home to those who can not come to Yale as well as to those who can. He has shown the school men of the country what we are trying to do in such a way as to help us to work together instead of separately.

I have purposely confined attention in this summary to the public activities which we already are in position to exercise, without mentioning those which are merely projected. A word should, however, be said of the plan for a forest museum which is in the mind of Mr. Gifford Pinchot. The Yale Forest School was organized just at a time when the American public was beginning to see the importance of the subject. We have had the good fortune to take the lead in this line of education, so that students come to us from every quarter of the world. Mr. Pinchot feels that it would be possible, by the establishment of a museum in connection with this school, to take the same position before the public as a whole that our courses of instruction have given us in the minds of students and specialists, and to make Yale the center to which the whole world will turn for its record of progress in forestry in the past and its suggestions of possible lines of progress for the future. Mr. Pinchot has already realized so many of his ideals that

we may look forward with confidence to his success in whatever he undertakes. I mention it at this moment as indicating the kind of public work which makes the modern university something more than a mere group of schools and elevates it to its highest possible rank—that of a public servant.

Besides its function in maintaining these public collections and lectures, a university should also be governed by a sense of public obligation in arranging its courses of study.

I have in a previous report spoken of this public duty as affecting the freedom of a university in determining the requirements for admission to its professional schools. However convenient it might be to insist on the possession of a bachelor's degree by all pupils in the schools of law and medicine, I feel that it would be a violation of our duty to these professions to hedge ourselves about by any such artificial limitations. We should make the standard of admission to our law and medical schools higher than it is at present; but we should base it upon qualifications for professional study which we could test by an examination, rather than upon previous residence at an institution entitled to give a bachelor's degree. If a man is really fit to study law or medicine we should encourage him to study law or medicine with us, without making arbitrary restrictions.

Considerations of public duty have an important bearing in determining what we shall require for entrance to our undergraduate courses also.

The whole question of entrance requirements is often discussed as though these were things which the college had a right to fix for itself. This is an error. There is a great difference in this matter between the position of a public institution, such as we think Yale to be, and a purely private one. If a man keeps a private school he can make any rules which he pleases regarding the admission of his pupils. If we think these rules are arbitrary or whimsical we may question their wisdom, but we can never for a moment question his right to make them. The case is different with a public institution. If a place like Yale, honored by the presence of the highest officers of the commonwealth in its corporation, and exempt by law from many of the taxes which are paid by others, should choose to make its rules arbitrary, the public would have a grievance. It would say, and say justly, that Yale had exceeded its rights.

Yale is charged with the public duty of educating a large number of boys who, having reached the age of seventeen or eighteen years, and having acquired the freedom which naturally goes with that age, desire to spend time in the acquisition of general culture and broad points of view before narrowing themselves down to the work of the office or the shop. She will err if she makes her requirements so lax as to encourage the coming of idlers, who will waste their own time and interfere with the seriousness of purpose of their fellows. But she will also err in the opposite direction if for her own convenience she makes those requirements so narrow that hard-working boys in the high schools and academies of different parts of the country can not get the teaching which is needed in order to enable them to enter Yale.

It is wrong to say that whatever Yale requires the schools will furnish. Some schools doubtless will; others will not. If the Yale requirements should get so far out of the line of work furnished by the better kind of high schools in the country that we could not expect to get boys from those schools, we should soon become a local institution. Yale would be a school for boys of one kind of antecedents, instead of for boys of all kinds of antecedents; and as soon as it became a school for boys of one kind of antecedents only, it would lose its

value as a broadening influence to its students and as a factor in the life of the whole nation.

Our policy with regard to entrance requirements is thus governed by two separate considerations: our duty to ourselves of not admitting boys except those who are able to do the kind of work which will be required of them, and our duty to the public of admitting all kinds of boys who can do this, on as equal terms as possible. Our student body must be at once hard working and national.

In order to make ourselves national we admit boys to our undergraduate courses by examination only and not by certificate. We believe that the examination method is fairer to boys who come from distant places. The certificate system is the natural one for a state university, which draws its pupils chiefly from the schools of one locality and can inspect and examine those schools; but if a national university tries to apply this system it gives either an unfair preference to the boys from schools near at hand, or an inadequate test to the boys from remote ones. We believe also that the examination system brings us the kind of boys who can take the best advantage of the opportunities we offer. By refusing to admit on certificate we lose some good boys who are afraid of an examination; but as a rule, the boy who is afraid to stand an examination on a subject where he has been well taught is better fitted for the protection of a small college than the liberty of a large one.

The subjects of our examination must be such as to prove whether the student can or can not pursue our courses to advantage. We must have enough mathematics to test the power of precise thought and enough language to test the power of precise expression. We can not allow other subjects to be substituted for these merely because we believe that it is a good thing to have these other subjects taught in the schools. In this respect our policy has differed radically from that of Harvard. When the question has come up of introducing music or wood-working among the entrance requirements, the question with Harvard has been mainly, How far does the college desire to encourage the teaching of music and of wood-working in our high schools? The question with Yale, on the other hand, has been, Can a student who is deficient in grammar be properly admitted to the college because he knows music? Can a student who is deficient in certain parts of his algebra properly be admitted to the scientific school because he understands wood-working? Every new subject introduced as an alternative to the entrance requirements means not simply that we are ready to cooperate with the schools in teaching that subject, but that we value it sufficiently to be content to get on with less than we formerly required of the things which were once considered essential.

On account of this difference in view Harvard has gone rapidly in the introduction of alternative entrance requirements, while we have gone slowly. Our scientific school has not found that the submission of notebooks and experiments, or the examination which could be given in various forms of descriptive science, could well be made a substitute for mathematical theory. It has indeed encouraged pupils from schools where there were good laboratories to pass a supplementary examination on laboratory practise and has admitted them to advanced sections; but it has insisted that these examinations should be regarded as supplementary to the regular requirements instead of excusing the student therefrom. Our academic department has introduced modern languages as substitutes for ancient languages only when they could be made real substitutes. We accept French instead of Greek only when it is a

real equivalent to Greek. Whatever language a boy presents, we insist that his knowledge of it should be precise. We do not let general information take the place of a knowledge of grammar.

It has been charged by critics of the old system of classical study that Greek has been a college fetich. This certainly has not been the view at Yale. We required Greek in the past not because we worshipped Greek, but because in times past the Greek teachers in the schools were the ones who were best able to insist on certain kinds of training which we thought our students needed. Some schools now have French teachers who can give this same kind of training in French. We are ready to accept the boys from those schools with French instead of Greek. To do this is not a departure from our old principles, but a continuation of it. The majority of French teachers are as yet unable to meet our requirements regarding French. Hence the majority of pupils who try to substitute French for Greek fail. Professor Wright's report shows that it is considered fully as hard to enter Yale without Greek as with it. This proves that the widening of the requirements has not been accompanied by a lowering of the standards.

It is probable that as more teachers of modern languages become acquainted with the requirements of the Yale examination we shall get a larger number of freshmen who prepare in modern languages instead of Greek. But this will not prove that we have changed our standard. It will prove that the schools have changed theirs. By adapting our choice of subjects to the needs of the schools we can make the schools adapt their method of teaching to our needs.

In order to do this we shall probably continue to hold separate examinations instead of joining with other colleges. We recognize the high degree of skill with which the Harvard examinations have been conducted. We recognize also the value of that cooperation between schools and colleges which is exemplified in the management of the Middle States' Examination Board. Under proper restrictions, we can accept some of the results of these examinations in determining the fitness of the pupil to enter Yale. But there is enough difference of purpose between us and Harvard to make a strong argument for those who wish our separate examinations continued —and the demand for their continuance, by the way, comes even more strongly from the schools than it does from the members of our own faculty. The Harvard paper seeks to test knowledge; the Yale paper seeks to test accuracy. The Harvard examination tries to find how well a boy has done his work in school; the Yale examination tries to find how well the boy is going to be able to do his work in college. The Middle States' system is intermediate between the Harvard and the Yale systems in these respects, and it is possible that in the near future we may all come together on this median line. We shall certainly do it whenever the great majority of the secondary school teachers demand it. But the results of the correspondence in the report of the Dean of Yale College indicate that the demand for separate papers is stronger than the demand for one consolidated paper. There is a large number of school teachers who find the accuracy incident to the Yale method of examination a great help in resisting certain evils which the widening of school courses during late years has brought with it.

SCIENTIFIC BOOKS.

Outlines of Industrial Chemistry, A Textbook for Students. By Frank Hall Thorp, Ph.D., Assistant Professor of Industrial Chemistry in the Massachusetts Institute of Technology. Second edition. New York, The Macmillan Co. Price $3.50.

This is a revised and enlarged edition of the work first published by Professor Thorp in 1898. While the earlier edition noted the most important inorganic and organic industries, the subject of metallurgy was entirely passed by because, as the author stated, instruction in it is generally given independently of that relating to technical chemistry. In this newer edition, however, he has thought it best to include an outline of elementary metallurgy and this, therefore, covers 54 pages and constitutes Part III. of the book.

Thorp's 'Chemistry' is too well known to need an introduction to teachers of chemistry, and its well-merited success has brought about a revision that can not but help to make it more generally acceptable for purposes of instruction. While it is obviously impossible for any one man to write with the authority of personal acquaintance with the dozens of distinct industries and hundreds of special manufacturing methods now in active use in this country and abroad, Professor Thorp has made diligent use of the literature, references to which are found at the end of each section, and he has, in his capacity as a teacher, made numerous visits with his classes to industrial plants and witnessed the actual working of many chemical processes. Indeed, the evidence of this is found so unmistakably in his frequent use of workmen's factory terms, given in quotation marks, that it has the effect, not always to be desired, of localizing the particular process described.

In general, the accounts of the individual chemical industries are clearly given, accurate and brought up to date. We note in this connection the account of the sulphuric acid manufacture, in which both the older chamber method and the newer contact processes are very satisfactorily explained and illustrated. The chlorine industry also is very fully treated, although some of the methods described will probably only have an historical interest before many years with the rapid development of the electrolytic methods for chlorine and caustic soda, in which the chlorine is the product for which sufficient utilization has to be sought. These electrolytic processes, by the way, are also very well presented and described.

The account of the manufacture of nitric acid is equally good, embodying as it does recent improvements like Guttmann's and Hart's and the experimental work at Niagara Falls on the production of nitrogen oxides from the action of high-tension electricity on the atmosphere.

We note similarly satisfactory sections on the fertilizer manufacture, and mineral colors or pigments, which latter is quite full and is supplemented by a list of well-selected references.

With these many points of excellence it may be allowed to note one or two cases in which the presentation of the subject is not quite up to the general standard. The statement on page 41 that 'the price of the foreign sulphur brought into this country is too low to allow profitable working of the deposits in this country' was true a few years back, but in 1904 the Union Sulphur Co. of Louisiana produced 200,000 tons of a native sulphur of exceptional purity and began the invasion of the European markets. To prevent the serious crippling of the Sicilian sulphur industry, the Anglo-Sicilian Sulphur Co. has just made a compact with the American Company, by which they give the latter the undisturbed field of the United States and a part of Europe in return for the maintenance of prices. Similarly the statement of the American bromine production methods on page 227 is hardly an adequate picture of the industry which within the last two or three years has had a great development in Michigan, in consequence of the use of electrolytic methods for liberating chlorine.

Part II., devoted to the 'Organic Industries,' covers exactly the same number of pages in the treatment as the Inorganic portion, and is also in the main very satisfactorily dealt with. This is especially true of the section on 'Explosives and on Textile Industries.' The same is true of other sections, although in the account of petroleum we do not find much mention of the radical differences in composition, and consequent differences in practical value, in the American petroleums, such as Pennsyl-

vania, Ohio, California and Texas crudes, that we might expect. In the section on 'Fermentation' also we find no mention of Buchner's great discovery of zymase in the expressed liquid from comminuted yeast-cells, which is now considered as the greatest advance in our knowledge of the action of the yeast plant since the time of Pasteur.

Part III., written for this edition by Charles D. Demond, S.B., in the space of 54 pages, gives a very excellent survey of metallurgical methods, covering all the technically important methods.

The book is undoubtedly the best book of its kind in the English language, covering in one volume of moderate size an outline of the manufacturing methods of technical chemistry.

SAMUEL P. SADTLER.

Inorganic Chemistry, with the Elements of Physical and Theoretical Chemistry. By J. I. D. HINDS, PH.D. Second Edition. New York, John Wiley & Sons. 1905. Large 8vo. Pp. viii + 651.

This work, on its first appearance, was carefully reviewed in this journal; it seems necessary, now, only to show in what respects the present edition differs from the former.

The plan of the book remains essentially the same, but there has been an increase of eighty-five pages, and the text has been revised. Several chapters have been enlarged or rewritten, and new chapters have been added. These changes affect mainly 'Theoretical and Physical Chemistry.' The treatment of these subjects is much better and fuller than in the earlier edition, but unnecessary *rules* and questionable statements may still be noticed. Is it well that a student should write structural formulas of acids by the following rule: 'Connect each hydrogen atom by an oxygen atom to the negative, then connect the remaining oxygen atoms, which are saturating, to the negative by both points'? Is it correct to say that 'the reaction of a salt is neutral'?

Although blemishes like the above are still too numerous, they are noticeably less than they were in the first edition. The excellence of the descriptive portion of the text is unquestioned, and the work in its present form should win new friends.

L. B. HALL.

HAVERFORD COLLEGE.

Cements, Limes and Plasters, their materials, manufacture and properties. By EDWIN C. ECKEL, C.E., Associate, American Society of Civil Engineers, etc.; Assistant Geologist, U. S. Geological Survey. New York, John Wiley & Sons. 1905.

This is an exceedingly valuable and well-nigh exhaustive work. It is by far the most valuable work on the several subjects that it treats that we have met, and in our judgment may be rightly considered a masterpiece of compilation. In the orderly and systematic arrangement of sub-subjects in the several parts and chapters the author's mastery of his general subject is exhibited not only to his own credit, but to the great pleasure and profit of his readers; for next to the enlightening information conveyed by an author comes the proper unfolding of a subject through systematic arrangement.

It is, however, as an engineer, of broad attainments outside the field of engineering, that Mr. Eckel addresses engineers. He does not profess to be a chemist, the chemistry of cements, limes and plasters is not mentioned in his title, therefore he may be pardoned if in the small space he devotes to the chemistry of these substances he follows the well worn path made by Mr. S. B. Newberry and Mr. Clifford Richardson's committee, which for some reason not clear to the general reader leads direct to the manufacturers of cement, leaving the interests of the *users* of cement completely uncared for. Nothing else could be expected, as Mr. Richardson's committee has the floor, and that committee recommends a method of chemical analysis that is ultimate and that, so far as chemical analysis is concerned, destroys the differences that exist in very unlike cements. A cement that contained five per cent. of uncombined silica and fifteen per cent. of combined silica would show twenty per cent. of silica on analysis by the method recommended by Mr. Richardson's committee, while a cement containing twenty per cent. of combined silica would on ultimate

analysis appear to be no better than the one first mentioned.

While in our judgment Mr. Richardson's committee is all wrong, and will ultimately be admitted to be so, it is hardly to be expected that Mr. Eckel would do otherwise than he has; nevertheless the book, addressed as it is mainly to those who *use* cements, limes and plasters, while well-nigh complete in other respects, is deficient in respect to furnishing a method of chemical analysis that will give results that enable one to distinguish good cements from bad cements.

We congratulate those seeking information upon this interesting subject that Mr. Eckel has given them such a comprehensive and valuable work.

A Treatise on Concrete, plain and reinforced; materials, construction and design of concrete and reinforced concrete. With chapters by R. FERET, WILLIAM B. FULLER, SPENCER B. NEWBERRY. By FREDERICK W. TAYLOR, M.E., and SANFORD E. THOMPSON, S.B., Assoc. M. Am. Soc. C. E. New York, John Wiley & Sons. 1905.

The preface of this work states: "This treatise is designed for practising engineers and contractors, and also for a text and reference book on concrete for engineering students."

As hydraulic cement is the basis of all concrete structures, this announcement exhibits the book as designed to inform and instruct those who *use* cement. While many of the technical and engineering problems involved in the use of cement in mortar and concrete are of interest to us, we naturally turned to those portions of the book devoted to the chemistry of cements and cement mortars. A careful examination of the book reveals an exceedingly interesting chapter by Mr. Spencer B. Newberry (a very successful manufacturer of Portland cement), on the 'Chemistry of Hydraulic Cements.' We found nothing in this chapter especially designed to instruct the *users* of cement. We looked in vain through the body of the work for anything concerning the analytical examination of cements, cement mortars and concretes. In an appendix we found the 'method suggested for the analysis of limestones, raw mixtures and Portland cements, by the committee on uniformity in technical analysis of the American Chemical Society, with the advice of W. F. Hillebrand.' As a method of ultimate analysis of the substances named the method proposed is well-nigh perfect; but for any purpose associated with the technical composition of cements, cement mortars and concretes, it has no value whatever.

The authors of this book are not chemists, hence they may be excused for any defects in the book involving a purely chemical problem; nevertheless, with all the good qualities the book possesses it is a defect that the book does not contain a scheme of chemical analysis by means of which good cements can be distinguished from bad cements and also by means of which the analyses of cements and cement mortars and concretes may be correlated with one another and with the physical tests of the cements used. We believe the time is not far distant when those who *use* cement will be brought to realize the supreme importance of such a method.

S. F. PECKHAM.

Technique de psychologie expérimentale (Examen des sujets). In Toulouse's 'Bibliothèque internationale de psychologie expérimentale.' Toulouse, Vaschide et Piéron. Paris, O. Doin. 1904. Pp. 335.

The scope of this work is much more limited than the first title would indicate; the subtitle indicates more exactly the ground covered; yet the scope is still narrower than this at first suggests. The book does not, of course, attempt to condense into one small volume the whole subject of experimental technique in psychology; it limits itself definitely to the technique of 'tests,' by which the mental traits of individuals are measured. But, further, the book makes no attempt to cover the already rather extensive literature of mental tests; it scarcely refers at all to other authors. Its sole and consistent purpose—a purpose which has guided the authors in several years of experimentation, of which this book presents the outcome—is to formulate a system of mental tests which shall take

rank as the standard tests, and so introduce order into the existing confusion, and make the future results of different workers in this field comparable with one another. The principal difficulty to which the authors address themselves is the selection of materials and conditions which can be described with such scientific precision as to be reproducible from the mere description by any other worker. For example, in a specially difficult test to standardize, that for sensitiveness to faint colors, the authors use aqueous solutions of analin dyes; light passes through the solutions, under definite conditions, to the subject's eye, and his sensitiveness is measured by the strength of the weakest solution in which he detects the color. This seems, on the whole, the most ingenious of the authors' innovations, of which there are many. In addition to determinations of the least noticeable sensations and differences in sensation, the authors suggest a system of tests on memory, association, imagination, judgment, reasoning, attention, etc. They frankly point out the gaps in their system, which they are as yet unable to fill satisfactorily. A chapter is devoted to the general technique of experimentation, the necessity of noting the condition of the subject, and of excluding certain subjects as unsuited to psychological tests, the proper attitude toward working hypotheses and toward the literature of a question, the necessity, in addition to quantitative tests, of less rigorous observation, which should, however, be brought up as nearly as possible to the exact standard of experimentation. An appendix of sixty pages is devoted to the reprinting of tests which can be fully presented in alphabetical or musical notation.

In view of the slack attention to standard conditions that characterizes much work in psychology, this book should do considerable good. As the most serious attempt to present a standard series of tests, it is worthy of attention and a large measure of acceptance. It can not hope, of course, to be definitive, and, indeed, the authors repudiate any such claim. More is to be gained, perhaps, by insistence on the general principle of standard and exactly reproducible conditions, than by the conformity of all workers in the field to any one set of tests.

R. S. WOODWORTH.

COLUMBIA UNIVERSITY.

SCIENTIFIC JOURNALS AND ARTICLES.

THE first number of *Economic Geology*, a semi-quarterly journal devoted to geology as applied to mining and allied industries has been issued under the editorship of John Duer Irving, of Lehigh University. The associate editors are: Waldemar Lindgren, Washington, D. C.; James Furman Kemp, Columbia University; Frederick Leslie Ransome, Washington, D. C.; Heinrich Ries, Cornell University; Marius R. Campbell, Washington, D. C., and Charles Kenneth Leith, University of Wisconsin. The contents of the first number are: 'The Present Standing of Applied Geology,' Frederick Leslie Ransome; 'Secondary Enrichment in Ore-Deposits of Copper,' James Furman Kemp; 'Hypothesis to Account for the Transformation of Vegetable Matter into the Different Varieties of Coal,' Marius R. Campbell; 'Ore-Deposition and Deep Mining,' Waldemar Lindgren; 'Genesis of the Lake Superior Iron Ores,' Charles Kenneth Leith; 'The Chemistry of Ore-Deposition—Precipitation of Copper by Natural Silicates,' Eugene C. Sullivan; Editorial; Discussion; Reviews; Recent Literature on Economic Geology; Scientific Notes and News.

The American Museum Journal for October is termed the Batrachian Number, its major portion being devoted to an illustrated synopsis of the salamanders, toads and frogs that have been found within a radius of fifty miles of New York City. The text is by R. L. Ditmars, illustrations from photographs by Herbert Lang, mainly of animals living in the New York Zoological Park. W. M. Wheeler tells 'How the Queens of the Parasitic and Slave-making Ants establish their Colonies,' and announcements are made of three courses of lectures, for members, pupils and teachers, in October–December. There are, besides, many notes concerning additions to the collections and other features of interest at the museum. The figures of the batrachians are

excellent, the nearly life-size picture of a bullfrog that forms the frontispiece being particularly fine.

THE special feature of the *Zoological Society Bulletin* for October is the announcement of the reception at the park of a young African elephant of the small-eared species, from West Africa known as *Elephas cyclotis*. Few realize that specimens of the African elephant are far more uncommon in this country than mastodons and it is quite probable that this specimen is the first of the species seen in the United States. Other interesting animals on exhibition are the great anteater, echidna, crested screamers and ruffs.

The Museum News (Brooklyn) for October has for its longest article an account of the rearrangement of the insect room at the Children's Museum, to better adapt it to the needs of teachers and children. The collections comprise a very considerable number of the local insects, examples of the largest and smallest insects in various orders, and instances of striking differences between the males and females. These are supplemented by small groups showing life histories, interesting habits, protective coloration and mimicry. There is an extended series of lectures at the Children's Museum for pupils. Various changes are noted at the Central Museum, in the main already announced in SCIENCE. An interesting addition to the collection illustrating variation is a group of eleven ruffs, *Pavoncella pugnax,* in full breeding plumage, showing the striking differences found among these birds.

SOCIETIES AND ACADEMIES.

THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION.

THE first regular meeting of the season was held at the Chemists' Club, Friday evening, October 6, 1905. The program of the evening was as follows:

R. H. WILLIAMS and H. C. SHERMAN: *The Detection, Determination and Rate of Disappearance of Formaldehyde in Milk.*

Using a method which permits approximate estimation of any amount of formaldehyde greater than 1:160,000, it was found that even aqueous solutions of formaldehyde of 1:10,000 to 1:40,000 lose strength steadily on standing at room temperature, the loss being due to an actual destruction, and not merely to polymerization, of the formaldehyde; while when added to milk in the same proportion formaldehyde disappears ten to twenty times as rapidly as from water.

The hydrochloric acid and ferric chloride test is capable of showing 1 part of formaldehyde in 250,000 parts of milk. Sourness of the milk does not in itself diminish the delicacy of the reaction, but when milk is preserved by means of formaldehyde the latter will have largely disappeared before the milk becomes sour. Considerable data regarding the time required for the disappearance of the reaction is given.

The gallic acid test, applied to the distillate obtained from the milk after acidulation with sulphuric acid, is much more delicate than the hydrochloric acid and ferric chloride test, and gives more conclusive results with samples which have stood until the formaldehyde has largely disappeared.

J. B. WHITNEY and S. A. TUCKER: *Observations on the Preparation of Metallic Calcium by Electrolysis.*

The method used was that of J. H. Goodwin, and the attempt was made to improve the yield of the metal. The electrolyte was molten calcium chloride. The apparatus used at first was similar to Goodwin's and the results obtained agreed satisfactorily with his. It was found that the proper temperature limits were so difficult to maintain that a new form of kathode was devised, in which the temperature of the iron rod was kept down by water cooling. With this improvement the yield of calcium was increased to sixty per cent.

A modification of the kathode was tried in which the iron kathode was inclosed by an insulated graphite bell, the object being to prevent the oxidation and chlorination of the calcium as formed, but it was not found to work well in operation.

F. H. POUGH,
Secretary.

SAN FRANCISCO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY.

THE eighth regular meeting of the San Francisco Section of the American Mathematical Society was held at the University of California on September 30, 1905. During the morning session the following officers were elected for the ensuing year:

Chairman—R. E. Allardice.
Secretary—G. A. Miller.
Program Committee—E. J. Wilczynski, D. N. Lehmer and G. A. Miller.

Seventeen members of the society were in attendance; in addition to these there were present a number of high school teachers of mathematics who are not members of the society. The following papers were read and discussed during the two sessions of the section.

PROFESSOR C. A. NOBLE: 'Note on Loxodromes.'

DR. W. A. MANNING: 'Groups in which a large number of operators may correspond to their inverses.'

PROFESSOR M. W. HASKELL: 'A new canonical form of the binary sextic.'

PROFESSOR A. O. LEUSCHNER: 'On a new method of determining orbits.'

PROFESSOR ARTHUR RANUM: 'The representation of linear fractional congruence groups with a composite modulus as permutation groups.'

PROFESSOR E. J. WILCZYNSKI: 'On a system of partial differential equations in involution.'

PROFESSOR G. A. MILLER: 'The groups which contain only three operators which are squares.'

PROFESSOR R. E. MORITZ: 'On logarithmic involution, the commutative arithmetic process of the third order.'

PROFESSOR L. E. DICKSON: 'The abstract group simply isomorphic with the general linear group in an arbitrary field.'

PROFESSOR L. E. DICKSON: 'The abstract group simply isomorphic with the symmetric group.'

PROFESSOR M. W. HASKELL: 'On a class of covariants which give rise to birational transformations.'

The next meeting of the section will be held at Stanford University on February 24, 1906.

G. A. MILLER,
Secretary of the Section.

DISCUSSION AND CORRESPONDENCE.

STEGOMYIA AND YELLOW FEVER—A CONTRAST.

THE magnificent work done in New Orleans this summer and autumn in fighting the yellow fever outbreak on the sole basis of the transfer of the disease by *Stegomyia fasciata*, and which has resulted in the practical extirpation of the epidemic long before the first frost, has convinced the most stubborn among the citizens of New Orleans and many other cities and towns throughout the south of the fact that only in this way can an epidemic successfully be handled. The acceptance of what has been termed 'the mosquito theory' is now almost universal, and this brings us to the contrast.

In the *New Orleans States* of May 2, 1902, appeared an article with the following scare headlines: 'Taxpayers to Protest Against Passage of Anti-mosquito Ordinance. Has been Resurrected. A Meeting To-night. Property Holder Discusses Taxation without Benefit.'

In the body of the article the following statements are made:

An effort will be made to resurrect the anti-mosquito ordinance at the next meeting of the committee on police and public buildings to which are entrusted for consideration all questions pertaining to public health. The measure was introduced last November by Mr. Cucullu at the request of Dr. Q. Kohnke, president of the city board of health. The measure was not popular, as the taxpayers contended that its enactment was but another form of enforced taxation. * * * Because of its evident unpopularity, the promoters of the ordinance requested that it be not pressed, and for that reason it has remained untouched before the committee ever since.

In the meantime the endorsement of medical men and organizations has been sought with more or less success, so that now Dr. Kohnke feels that the chances are more favorable to call the measure up. * * *

But there are many taxpayers who are determined to resist the passage of the ordinance, and should it be defended by the committee on police and public buildings at its meeting next Monday evening * * * there will be taxpayers present who will strive to prove to Dr. Kohnke that the arguments in favor of this new venture are not so strong and convincing as he believes.

A special meeting of this taxpayers' protective association has been called to be held this evening at 7:30 o'clock. * * *

'The passage of the proposed ordinance,' said a prominent taxpayer this forenoon, 'would be nothing short of an outrage.'

I wonder what this 'prominent taxpayer' thinks about the ordinance now. It is a sad thing to suggest, but possibly he himself or some member of his family has died as a result of the senseless opposition, in which he took part, to a reasonable and public-spirited health measure.

In an evening paper of March 28, 1902, there appeared a note to the effect that a correspondent of the Associated Press had a talk with the State Health Officer of Texas, regarding the mosquito theory. He was reported as of the opinion that 'The theory won't hold water,' and stated that he would not accept it. He stated that he had been familiar with yellow fever from childhood and 'knew enough to keep rigid quarantine and disinfecting rules in effect.' A little more than a year later, however, he had a new lesson in the Texas outbreak of yellow fever in the late summer and autumn of 1903, and he too changed his mind in regard to mosquitoes.

L. O. HOWARD.

THE POSSIBILITY OF ABSORPTION BY HUMAN BEINGS OF NITROGEN FROM THE ATMOSPHERE.

ANY one reading this article would conclude that it has been proved that plants can absorb free nitrogen from the atmosphere without the aid of bacteria, and that Dr. Wohltmann is a believer in this. The quotation which the writer gives does not bear out this interpretation of Dr. Wohltmann's work:

The association of the plant with the bacteria is not a necessity but an expedient, and whenever there is a rich supply of nitrogenous elements in the soil, they (the plants) dispense with the bacteria and *with the free nitrogen*, which the latter make available, by directly secreting it from the chemical combination of soil or air in which it is held suspended.

The italics are mine, but the translation is by Mr. Gibson. Dr. Wohltmann is far from saying that plants absorb free nitrogen in the absence of bacteria; but distinctly says, in the above quotation, that in the absence of the bacteria they dispense with the free nitrogen and take the nitrogen necessary for their growth in combination from the soil.

This is no new discovery, for Hellriegel, in 1886 and later, showed by decisive experiments that when the bacteria are absent, Leguminosæ, like other plants, can only take their nitrogen in compounds, and their growth, within limits, is a function of the combined nitrogen presented. In the presence of bacteria Leguminosæ can utilize the free nitrogen of the air, and build it up into organic compounds.

Before speculating on the possibility of the absorption of free nitrogen by human beings, it is well to remember that there is no evidence that higher plants can assimilate nitrogen of the air without aid of bacteria.

G. S. FRAPS.

A TREE'S LIMB WITHOUT BARK.

TO THE EDITOR OF SCIENCE: In the summer of 1902 a large ash tree, some two feet in diameter, on the university campus was struck by lightning. The current, after knocking off a few branches, passed down on both sides of the main trunk leaving here merely two small furrows in the bark. From one limb, some six inches in diameter and perhaps ten feet from the ground, the bark all around was completely stripped for a distance of about five feet. To the surprise of some of us the leaves on this branch did not wither, nor fall to the ground till the leaves of the rest of the tree fell in the autumn. The next spring the leaves put out on this branch as on the rest of the tree; so again in 1904 and again the present year. In other words, the vegetation of this branch, wholly girdled for a space of several feet, differs from that of the rest of the tree only in being slightly less vigorous. The wood of the girdled portion looks much like a seasoned log of ash wood. The tree itself is rather less vigorous than the neighboring ashes, and will probably survive but a few years longer. Is it common for a limb,

stripped of its bark, to thus survive for three seasons? JAS. LEWIS HOWE.

WASHINGTON AND LEE UNIVERSITY,
LEXINGTON, VA.

SPECIAL ARTICLES.

PHYSICAL CHARACTERS AND HISTORY OF SOME NEW YORK FORMATIONS.[1]

WE are accustomed to define historical geology as the history of the earth and its inhabitants, and this definition no doubt fully covers the subject. But it may be questioned if, in the ordinary treatment of the subject, such as it receives in our current text-books and lecture halls, we do it justice to the full extent suggested by our definition. Is it not too often merely the history of the inhabitants of the earth that we are treating, giving the history of the earth itself, *i. e.*, its physical development, only scant recognition? I believe I am not going too far when I say that we give proportionately too much attention to the biologic or paleontologic side, and too little to the physical or stratigraphic. I do not wish to be understood to say that paleontology receives too much attention in our institutions of learning. Far from it. Paleontology is not receiving a fraction of the attention it requires, and which it will receive in the future when our curricula are more normally balanced. But paleontology is not the whole of historical geology. Stratigraphy, or the physical characters and physical history of the rocks of the earth's crust—paleophysiography (if I may use a pet term, in spite of objections raised against it)—is fully one half of historical geology.

It is true, of course, that historical geology reposes on a foundation of paleontology—the divisions of the earth's history are based on the progress of life, and not, as has been too often assumed, on breaks in the sedimentary series, extensive and important as these may be. The standard of comparison must be a series of sediments which contain a continuous record of development, and since it is only in marine sediments that we get a continuous series, only marine formations, and such as do not represent merely local conditions, must be selected as our standard of reference.

Much as we prize, and justly prize, the classical standard of our North American Paleozoic series—the incomparable column furnished by the strata of the state of New York—and loath as we may be to attack any part of it, yet we must confess that it is not a perfect column throughout, and that the imperfection which it embodies can not be overlooked. Indeed, the sworn guardians of this monument have themselves recognized that it is an incomplete structure, and have introduced such foreign elements as the Cincinnatian group and the Richmond formation, besides accepting emendations proposed by others, such as Acadian and Georgian. They have, however, sought consolation for this forced recognition of the imperfections of the New York series, by proposing that the world at large accept the broader terms of the New York classification—Taconic, Champlainic, Ontaric—in place of the better known, though not always prior, terms Cambric, Ordovicic and Siluric.

But it is one thing to recognize the absence of an element in the standard series and to fill the gap by a foreign representative, and another to regard an old and well-known formational unit as imperfect, and as inexpressive of the time element which it represents, and to acquiesce in its replacement by another. Yet I believe this is what we shall come to in the case of such old standards as the Medina sandstone and the Salina group, not to speak of the Oneida conglomerate, formations which are still tolerated in the standard scale of North American Paleozoic formations, but which in a very imperfect manner represent the chronologic epochs for which they are commonly used. This is due to the fact that they were not deposited in the open sea, but rather under peculiar conditions, *i. e.*, estuarine, if not continental, in the case of the Oneida and Medina, and salt sea, if not desert, conditions in the Salina. Moreover, it is now pretty well ascertained that the typical Oneida

[1] An address delivered before Section E, American Association for the Advancement of Science, Syracuse meeting, July 21, 1905.

conglomerate of Oneida County is the time equivalent of the Upper Medina of the Niagara section, and that both probably should be united to the Clinton, while the lower 1,100 feet of the Medina of western New York may possibly represent the continental or estuarine phase of deposits, representing elsewhere the later Richmond period.

A satisfactory standard for the Lower Siluric is found in the island of Anticosti; and although this belongs to another geographic province of the Siluric seas, it represents far more completely the progress of biologic development than do the lower beds of the New York Siluric or, for that matter, any other Siluric beds deposited in the Siluric Mediterranean; unless the Mayville beds of Wisconsin should prove to represent the lowest Siluric.

To go, for a moment, outside of New York state, the same argument applies to the sediments of the mid-Carbonics, or Pennsylvanian, of eastern United States. Though now taken as a standard for comparison, to which all other Carbonic formations of North America are referred, they are manifestly unfit for this important position, not only because they represent continental conditions, and do not furnish us with a standard of marine sedimentation, but because it is obviously impossible to determine, at least with our present means, how complete the series is. There may be, and probably are, vast breaks in this series of non-marine sediments, breaks which may or may not be revealed in the floral succession. A far more satisfactory standard, and one more nearly comparable with the European standard, is that furnished by the mid-Carbonic sediments of Arkansas, Missouri and Kansas, or by those of Texas. When these sediments and their marine faunas have been fully studied we shall have a mid-Carbonic standard worthy of the name; and when that is accomplished—as we have good hopes that it will be before long, judging from the results already achieved by the labors of the earnest workers in those fields—then let us hope that the inappropriate term Pennsylvanian will be replaced by one more expressive of the marine sedimentation of that age.

But I am not here to speak of the imperfection of the geologic record, an imperfection which I think is more apparent than real, nor of the imperfection of our classification, which is more real than apparent. What I have said, however, will serve to define my position with reference to the importance of paleontology to the geologist. Let me return, then, to the consideration of the importance of the physical characters of our formation. I believe that the general neglect which this phase of the subject has suffered is in part due to the clumsy and unrefined nomenclature which we have inherited from the fathers of our science, and which, with the tacit, if not expressed, understanding that what was good enough for them is good enough for us, we have retained to the present time. So long as we express in our nomenclature that all stones composed of lime are limestones, and nothing more, so long, I believe, progress in the study of physical stratigraphy will be hampered. So long as we are content to use indiscriminately the structural terms slate and shale for rocks which have no other claim to these names than that clay generally enters into their composition—if that may be considered a claim—so long progress in this direction will be retarded. Naumann and Hauy long ago proposed textural terms for the three great types of clastic rocks, but these have been mostly overlooked by modern writers except the Germans, who are far ahead of us in the study of physical stratigraphy. It is true the terms of Naumann and Hauy, derived from the Greek, are not very euphoneous, nor do they lend themselves readily to composition, yet they are much better than indefinite descriptive phrases. Calcopsephyte and calcopsammyte do not fall pleasantly on the ear, yet they are far better than the indefinite terms, brecciated limestone—which might mean limestone brecciated by subsequent causes—or granular limestones—which might mean a number of different things. Certainly calcopelite is far better than the vague and roundabout phrase: 'compact, fine-grained limestone with conchoidal fracture,' which leaves you still in doubt whether the rock in question is a clastic, composed of lime flour, or a massive

organic rock in which all organic structure has been obliterated. Personally, I prefer terms derived from the Latin as being more adaptable in composition in this instance than the Greek terms of Naumann and Hauy; but whether we say calcopsephyte, calcopsammyte and calcopelyte or calcirudyte, calcarenyte and calcilutyte, is of minor significance, so long as we employ a term which will express exactly the physical characters of the rock. If the name at the same time expresses, in part, the history of the rock, by indicating it to be a clastic and not an organic rock, this can only be regarded as a further advantage. Certainly, if you understood that a lutyte was a clastic rock composed of fine rock flour, you would, I think, be in favor of describing many of the beds of the Manlius and water-lime of this region as argillaceous calcilutytes or pure calcilutytes, as the case may be, rather than to speak of them as: 'compact, finely-bedded argillaceous limestones with conchoidal fracture and of an impalpable grain.' I should, at any rate; for, if nothing more than brevity is gained, the short term is a distinct advantage.

But the application of a more precise nomenclature to the clastic rocks is only a first step in the right direction. The lithic character of the rocks must be studied with reference to their origin, *i. e.*, the lithogenesis of the formations must be considered, and the bearing which this has on the distribution of land and sea in past geologic epochs. The careful study of local sections, the measurements of thicknesses and the determination of the distribution of fossils, are of course, an important preliminary. But while this is done, a careful diagnosis of the lithic character of the rock and a determination of its source should be made, and special care should be given a precise description of its relationship to adjacent formations. The latter feature is too often neglected, when it is of the greatest importance, as an example will show. Most of the descriptions of the Chattanooga black shale which I have been able to find speak of it as a black bituminous shale, with some few additional remarks on its petrographic character. They mention the fossils which are found in it and refer the formation to the Devonic, with sometimes a more precise reference to the Marcellus or the Genesee of New York. But its relation to the succeeding formation is almost never discussed. Here and there in the literature we find a hint, and only a hint, that it grades up into the overlying rock. Rarely is there a more precise description of this gradation, like William's description of its relation to the overlying Grainger shale. And yet this is of very great importance, for if the Chattanooga shale of eastern Tennessee is Devonic, then there is not only a pronounced hiatus at its base, but another at its top, for the immediately overlying Fort Payne beds represent in some localities the St. Louis, in other the Keokuk. In still other localities we find beds of Chester age following immediately upon the black shale, which often is only a few feet thick, while in other localities again these black shales are succeeded by beds of Burlington or Kinderhook age. If, as I strongly suspect, and as seems to be occasionally hinted at in the literature, there is no hiatus at the top of the black shale, but a transition to the overlying formation, then the black shale surely represents the basal formation formed by a sea transgressing southward and eastward over a peneplained land surface, and its age varies in different localities. At the type locality, Chattanooga, Tennessee, the age of the black shale is in that case Burlington or perhaps early Koekuk, while at others its age is St. Louis, or even later. Only in the northern region, where it is succeeded by Kinderhook beds, as at New Albany, Indiana, and at Big Stone Gap, Virginia, is the black shale of Devonic age.

And this brings me to the consideration of another factor which is all too often overlooked in stratigraphic work. This is the phenomenon of progressive overlap, and the complementary one, which, for lack of a better term, we may call regressive overlap. We all agree that in normal sedimentation coarse clastic rocks are formed near shore, finer farther out and the finest impalpable flour is only deposited at a great distance from the normal shore, while clastic limestone may be

formed anywhere under favorable conditions. But we do not generally apply this principle in the elucidation of our rock sections. When, for example, a prolonged subsidence of the land occurs, resulting in the overflow of the land by the sea, the waves of the advancing sea will work over the residual soil of the land which it overflows and will spread a basal layer of conglomerate or sand or, in rare cases, of mud over the old land thus submerged, the nature of the basal bed depending on the character of the rock débris which covered the old land, the slope of this old land and the consequent depth of the encroaching sea, and the rapidity of the submergence. This latter may be so great that areas of land are suddenly submerged, while the shore is transferred far up on to the old land, so that offshore deposits, like organic limestones, may form directly on the old land surface.

The basal layer thus formed will not be of the same age throughout, but will rise in the scale with the advance of the sea. Seaward, finer deposits will be laid down upon the basal formations, these finer deposits corresponding in age to the basal sandstone at that time forming near the shore. To illustrate: the basal sands of the Cambric Ocean were spread by an advancing sea over the crystalline rock floor. East of Lake Champlain this basal sandstone belongs to the Lower Cambric, but westward it rises in the scale until at the foot of the Adirondacks it is the Potsdam sandstone of Upper Cambric age, while the corresponding deposits further east are clay and lime-rocks. Again, while on the east of the Adirondacks, at the point of present outcrops, the basal sandstone is Potsdam, followed by calciferous sand-rock and by purer calcarenytes of Beekmantown age, the outcrop on the west of the Adirondacks shows similar basal quartz sandstones, followed by calciferous sand-rock and later by pure calcilutytes, but all, from the base up, of Lowville or Upper Chazy age. The Beekmantown and Potsdam are here overlapped by the later deposits, which, however, repeat the lithic sequence seen in the section of earlier age on the east of the Adirondacks. Wells sunk in the neighborhood of Syracuse to the crystalline rock, find a quartz sandrock (silicarenyte) resting immediately on the crystalline, followed by a calciferous sand rock (calcareous silicarenyte), which grades up into siliceous calcarenyte, and finally into pure calcarenytes or clastic limestones. Lithically considered, this section might be regarded as representing the whole series from Potsdam up, whereas in reality the basal bed is Beekmantown, if not Upper Chazy.

Regressive movements of the sea, by which large tracts of previously submerged land become exposed, also leave a record in the sedimentary series which, by careful consideration, can be detected. Thus a comparison of sections shows that we have in the Mohawk Valley some three or four hundred feet of Beekmantown, which in places, as at Little Falls, rests directly upon the gneiss with a basal rudyte. These Beekmantown beds probably represent the lower, though probably not the lowest, members of that formation, judging from the presence of *Opheleta complanata.* Not more than a hundred and fifty miles south, in central Pennsylvania, the Beekmantown is represented by over two thousand feet of similar strata, followed by some two to three thousand feet of the Stone's River group, which in the Mohawk is represented by less than a hundred feet of its upper portion, and there known as Lowville. Similarly, in the upper Mississippi region the Lower Magnesian limestones, which indicate a continuous deposition from the Upper Cambric, are less than three hundred feet in thickness and represent the lowest Beekmantown. The Stone's River, or Chazy, is represented by less than a hundred feet of strata, which grade upward into the Black River, as do the corresponding strata—Lowville—in the Mohawk and Black River Valleys. These Stone's River beds of Minnesota, from their relation to the overlying beds, and from their fossils, are seen to be the uppermost portion of that series. Between the lowest Beekmantown and the highest Chazy (or Stone's River) lie about 200 feet of pure quartz sandstone—a typical silicarenyte—known as the St. Peter sandstone. This sandstone has been traced very widely over the Mississippi Valley region; but as

we follow it southward the thickness of Beekmantown below and Chazy above increases more or less regularly, until in Indian Territory, where the St. Peter thins away, we have nearly two thousand feet of the Beekmantown and more than that of the Chazy or Stone's River. These facts point to a very remarkable episode in North American Ordovicic history, namely, the slow retreat of the sea from the upper Mississippi Valley, which as it retreated gradually washed the sands of the northern shore seaward, spreading them over the previously deposited offshore beds. As the sea retreated, deposition came, of course, to an end. Thus when the retreat had reached southern Minnesota, only the lower 250 feet of Beekmantown had been deposited, and there deposition stopped. When the retreating seashore had reached central United States, only the lower thousand feet of Beekmantown had been deposited, and only in southern United States, which was not laid bare, was there a complete deposition of the calcarenytes and organic limestones of the Beekmantown. The area uncovered—the whole of central United States—was spread over by the sand left by the retreating sea, and this was no doubt blown about by the wind, the grains rounded and the remarkable structure and purity of the St. Peter—probably the best example of an ancient desert rock extant—was thus produced. When the sea again advanced over this desert area, the upper portion of these sands was worked over and became true water-laid deposits, and at the same time graded up into the overlying calcareous beds. By the time the sea had advanced half way to the old northern shore, a thousand feet, more or less, of the lower Chazy had been deposited in the southern states. At the point then reached Chazy deposition began with the middle members of the formation. By the time the sea had reached its northern shore, from which it originally retreated, and which was somewhere north of Lake Superior—the whole of the Chazy—nearly 2,000 feet had been deposited in the southern states, the upper thousand in the central states, but only the uppermost 50 or 75 feet in southern Minnesota. The St. Peter, thus representing a retreatal sandstone, worked over by the winds, also represents a basal bed of an advancing sea; and while the last remnants of it in southern United States mark practically no break in the sedimentary series, this same rock in southern Minnesota occupies the interval between all but the lowest Beekmantown and all but the highest Chazy.[2]

Now, in New York state we have no St. Peter, but we have the other conditions precisely like those of the upper Mississippi Valley. The lowest Beekmantown is followed by the highest Chazy, the interval unrepresented between the two being marked in central Pennsylvania by over 4,000 feet of sediment. This break, or stratigraphic unconformity, long suspected, has recently been actually located in the Mohawk Valley by Professor Cushing. It should be remarked that during all the time that central and western New York was dry land, *i. e.,* during the time occupied by the formation of 4,000 feet of limestone strata elsewhere, continuous or nearly continuous deposition went on in what is now the Champlain Valley.

We must now consider a somewhat more complicated series. In western New York the Lorraine beds—considered the highest of the Ordovicic—are followed by red lutytes and arenytes (mud-rocks and sand-rocks), over a thousand feet thick, and unfossiliferous. At the base is a quartz sandstone, about 75 feet thick, and over it are about a hundred feet of quartz sandstones, mostly red, and some shales which contain marine fossils closely allying them to the overlying Clinton. I speak, of course, of the Medina formation. A little south of Utica, the Lorraine shales, represented only by their lower hundred feet, are succeeded by the Oneida conglomerate, a pure quartz-pebble conglomerate with well-rounded pebbles. This conglomerate, less than 50 feet thick, is followed by the shales, sand, mud and lime rocks of the Clinton. The base of the conglomerate is fossiliferous, the fossil—*Arthophycus harlani*—being the same which is restricted to the top beds of the Medina in western New York. In the cement region of

[2] Dr. C. P. Berkey will shortly publish a detailed discussion of the St. Peter problem.

Ulster County a similar white quartz-pebble conglomerate, the Schawangunk grit, lies unconformably upon the upturned and eroded Hudson River beds, and is followed by less than a hundred feet of red lutytes and arenytes, and then by the cement beds, which, by their enclosed fossiliferous bands, prove their identity with similar beds overlying the Salina in western New York. Close inspection of the series shows continuity of deposition, which proves the age of the red beds and the Schawangunk conglomerate to correspond to that of the New York Salina. Still further east, in Rensselaer County, a similar conglomerate, the Rensselaer grit, rests unconformably on Cambric and Hudson beds. How shall we interpret these sections? At the end of Ordovicic time the folding of the Ordovicic strata of eastern United States took place—what is familiarly known as the Green Mountain revolution. So far no strata later in age than Lorraine have been found in these folded beds; hence it is safe to assume that strata of Richmond age were never deposited in eastern United States; in other words, that the folding began at the end of Lorraine time. This folding was, no doubt, accompanied by an elevation of the land, and a westward retreat of the interior sea. Elevation of an old land is commonly followed by vigorous stream activities, which results in erosion. In the present case the products of this erosion were spread by the streams over the land exposed by the retreating sea. This is the ultimate mode of origin of the conglomerates in question and of the red sandstones. The red colors of the sands and muds indicate that they are the product of the subaerial decay of rocks; and the only rocks at all competent to furnish the material of these strata are the crystallines of the Appalachian old land, as long ago pointed out by Davis and others. That the conglomerates and their representative in western New York, the basal sandstone of the Medina, are, in part at least, river deposits, later on worked over by the sea, seems unquestionable, for though the retreating sea would wash out seawards the materials of the shore, such thick masses of pebbles can hardly be carried so far from their source without the aid of rivers. A comparison of the Siluric sections of the Appalachians suggests that the conglomerates and sandstones are part of a huge subaerial fan, whose apex was in southeastern Pennsylvania, and which thinned away radially in all directions. That a part of this fan was formed during Richmond time seems probable, and is further indicated by the occurrence of marine Ordovicic fossils in what was probably the margin of the fan in Virginia. However, a great deal of careful comparative study is needed to unravel the complete history of these deposits.[3]

In central United States the Richmond is succeeded by marine deposits commonly correlated with the Clinton of New York. Though land conditions, accompanied by erosion, are indicated in many localities, in some cases the lowest Siluric sediments seem to rest directly upon the highest Ordovicic. It is impossible to determine from the literature whether in any of these cases continuous deposition occurred or not. Further field examinations will have to settle that. Marine conditions came into existence again in western New York in Upper Medina time, and gradually transgressed eastward. The Siluric sea reached as far as Utica in Upper Medina time, but did not reach Ulster County until the conditions of the deposition of the Salina beds were instituted in central and western New York—if at that time marine conditions existed at all in New York. The continued red sedimentation, which is so pronounced throughout the Salina sediments and which appears to indicate a continuous supply of highly oxidized material from the old land on the east, and, further, the presence of true Salina strata only along the inner margin of the Appalachians, their great thickness in the east and their thinning away to the west, all suggest that land conditions, rather than marine, existed in this period. That marine deposits were forming in some region is indicated by such sections as that near Cumber-

[3] Investigations of this problem are now in progress under the auspices of the New York State Geological Survey.

land, Maryland, but the typical salt and gypsum-bearing Salina beds, such as furnish the salt of Syracuse, have characters which seem explicable only on the supposition that all this region was a desert country, with much evaporation and comparatively little rainfall, and that the basins in which salt accumulated were shallow pools, rarely, if ever, flooded by the sea, the salt being bleached out of the surrounding marine sediments by the occasional rains and left by the evaporation of the water. But here, as in the case of the Medina, much detailed study of the lithic character of the formation is necessary before we can do more than make provisional hypotheses. We know, however, that marine conditions were reestablished over all New York towards the end of Siluric time. As Hartnagel and Schuchert have shown, the sea invaded eastern north America by a transgression of the Atlantic waters. At the same time a trangression from the southwest appears to have occurred, which brought with it a different type of fauna, the two together constituting the Cobleskill. The Manlius limestones represent typical marine conditions; but you will have noticed that many of the lime mud-beds or calcilutytes show mud cracks, which indicate water so shallow that occasional emergence was possible. The Manlius beds grade upwards into the fossiliferous calcarenytes, which, as the Colymans limestones, form the basal Devonic beds of the New York section. This and the higher beds of the Helderbergian series are now no longer found, except as remnants, in this region, erosion having removed most of them. You will bear in mind that this erosion was a pre-Onondaga erosion, for the Onondaga rests everywhere in this region upon the eroded surfaces of the Colymans or the Manlius. This erosion belongs to Oriskany time, for continuous deposition into the Lower Oriskany is shown by the section at Becraft Mountain. What the amount of erosion was and what the length of time during which it was accomplished, we have at present no means of judging. There is every reason to believe that the highest Helderberg strata extended at least as far as Syracuse, and there is reason to suppose that they extended farther and overlapped the lower ones. But the Oriskany erosion has removed all this. The hiatus, though pronounced, is scarcely noted by the casual observer, because the formations are perfectly conformable, so far as position of strata is concerned. We need a term to express the relation where two formations thus conform in their bedding but comprise between them a time break of greater or less magnitude. To speak of such strata as unconformable, without qualifying the term, is misleading, since it suggests that the older strata have suffered folding and erosion before the deposition of the later. Until a better term is proposed, we might speak of such formations as *dis*conformable, leaving the term unconformable for cases in which discordant relationship of bedding occurs.

The disconformable relation of the Onondaga upon the Manlius or Colymans is sometimes qualified by the occurrence of lenses of Oriskany between them. The relationship of the Oriskany and other overlying formations is best brought out by the consideration of a few sections. In the Hudson Valley the lowest Oriskany—that of Becraft Mountain—is a direct successor, without break of deposition, of the uppermost Helderbergian, the Port Ewen. It is succeeded by about three hundred feet of dark argillaceous silicilutytes, the lower part of which are the Esopus and the upper the Schoharie. Above this come the Onondaga limestones, the transition being a complete, though rather rapid, one. In the Schoharie Valley later Oriskany rests on eroded Helderbergs, and is followed by about 100 feet of the dark lutytes, mostly of Esopus or Caudagalli age. West of this region the Oriskany occurs at irregular intervals, while the Esopus has thinned away. Finally, at Cayuga Ontario, half-way between Buffalo and Detroit, the uppermost Oriskany alone occurs, resting on eroded lower Manlius and intimately related with the overlying Onondaga. Here, then, is no room for Esopus or Schoharie, for Onondaga is the direct and immediate successor of latest Oriskany. This indicates a westward transgression of Oriskany sediments, the later beds overlapping

the earlier ones. The dark mud rocks, therefore, are the shore equivalents in the east of the highest Oriskany limestones of the west, and not an independent unit in the time scale.[4]

But I must not carry my discussions further, since my time, unfortunately, is limited. I hope you agree with me—those of you, I mean, who are not stratigraphers, for stratigraphers require no conversion at my hands—that the study of the physical characters of the strata, even of the thickness of sections, gives, when rightly attacked, a view of the history of the earth, full of dramatic intensity, and that only by a careful study of such physical characters can we arrive at a true interpretation of the history of the earth.

A. W. GRABAU.

COLUMBIA UNIVERSITY.

[4] A more detailed discussion of this problem appears in my forthcoming bulletin on the Schoharie Valley (Bull. N. Y. State Museum).

EXTIRPATION AND REPLANTATION OF THE THYROID GLAND WITH REVERSAL OF THE CIRCULATION.

WE have successfully removed and then replanted a thyroid gland with reversal of the circulation on a dog.

A transplantation of the thyroid with anastomosis of its vessels to a suitable artery and vein was previously made in 1902,[1] but no permanent successful result was obtained, owing to the obliteration of the vessels by clots and the subsequent development of gangrene. A careful investigation of the literature has revealed no other mention of similar experiments having been performed hitherto. The present observation is also the first successful replantation of a gland with reversal of the circulation.

Summary of the Technique and of the Observation on the Results of the Operation.—The right thyroid gland of about a 20 K. dog having been dissected, all its vessels were ligated, except the superior thyroid artery and vein, which were cut near the carotid artery and the internal jugular vein. The gland was then extirpated and put in a glass of isotonic sodium chloride solution.

[1] A. Carrel, 'La Technique operatoire des anastomoses vasculaires et la transplantation des visceres,' *Lyon Medical*, 1902. 'Les anastomoses vasculaires, leur technique operatoire et leurs indications,' 2e Congrés des Médecins de langue francaise de l'Amérique du Nord, Montreal, 1904.

After a few minutes, the thyroid gland was placed in the wound in the neck, and the peripheral end of the thyroid artery was united to the central end of the thyroid vein, and the peripheral end of the thyroid vein to the central end of the thyroid artery.

The circulation was reestablished about half an hour after the extirpation. The circulation through the gland was in a direction reverse to the normal. The red blood entered through the thyroid vein, and the dark blood flowed from the gland to the jugular vein through the thyroid artery. The hue of the gland was normal, and the circulation very active.

Eleven days after the operation the wound was opened and the anterior portion of the gland directly observed. The gland was somewhat enlarged, but its hue and consistency were normal.

Twenty-five days after the operation it was again directly observed. It still appeared enlarged, and in hue and consistency the same as before.

Thirty-two days after the operation, the wound being almost closed, it was not possible to examine the gland directly. But by pressing it between the fingers through the skin, its systolic expansion was easily detected.

At the present time forty seven days after the operation the animal is alive and in good condition. The replanted gland appears to be practically normal, being only slightly enlarged.

ALEXIS CARRELL,
C. C. GUTHRIE.

THE HULL PHYSIOLOGICAL LABORATORY,
UNIVERSITY OF CHICAGO.

EXHIBITION OF EARLY WORKS ON NATURAL HISTORY.

FEW people are aware that the Natural History Museum in Cromwell-road contains one of the finest and most complete libraries on natural history ever brought together. The collection had its origin in the several libraries attached to the departments of zoology, geology, mineralogy and botany while these were

in Bloomsbury. After the removal to South Kensington, the four departmental libraries were considerably supplemented by extensive purchases, for which a special vote was obtained from parliament. At the same time a 'general library' was formed to receive those works the subject-matter of which concerned more than one of the departments. The collection has been further increased by many generous and munificent donations and by exchange.

The library, of course, contains many very early books on natural history; and from these a selection has been made for the purpose of an exhibition intended to illustrate the origin and progress of the study of natural history up to the time of Linnæus. The exhibition, which occupies two table-cases in the Central Hall, has been arranged by Mr. B. B. Woodward, the librarian of the museum.

We are told that the study of natural history began with the dawn of civilization, and doubtless had its origin, so far as animals and plants were concerned, in the primitive observations of the hunter and of the medicine-man, or priest-physician, while the search for stone, and subsequently for metals, with which to fashion weapons and tools, served to draw attention to the nature and structure of the earth. That the hunters of the stone age were not unobservant of the quadrupeds they pursued is evinced by the carvings and the incised outline representations on bone, as well as by the remarkable pictures, drawn in manganese and red ochre, on the chalk walls of the caves in the Dordogne. Examples of the carvings and reproductions of these drawings are shown in the present exhibition. Turning to books proper, we may note a copy of the oldest popular natural history book, the 'Historia Naturalis,' or 'Historia Mundi,' of Pliny the elder, printed by J. de Spira's press at Venice in 1469. This was one of the first, if not the first, of natural history books printed. It presents an epitome of the state of Roman knowledge on the subject, and in this connection it is of interest to note that the number of known plants recorded in it is about 1,000. Mention may also be made of a copy of Vincent of Beauvais's 'Bibliotheca Mundi,' compiled by that learned Dominican at the instance of Louis IX. of France. This work is not only one of the earliest of encyclopedias, but the greatest of the middle ages. It was first printed at Strasburg about 1473.

The Royal Society is represented by a copy of the first volume of the *Philosophical Transactions,* the earliest publication of any scientific society. It was issued in monthly numbers, of which the first appeared in March, 1665, and for the most part deals with physics.

A special interest attaches to an edition of the 'Stirpium adversaria nova' of Pena and L'Obel, printed at Antwerp by Plantin and finished in England in 1570–1. It contains one of the earliest figures of the tobacco plant and an illustration of the method of smoking of the North American aborigines. The pipe is drawn as being somewhat straighter than the Atlantic coast ones generally were.

The earliest illustrations of the potato plant are seen in a work by Charles de Lécluse, the 'Rariorum Plantarum Historia,' printed at Antwerp in 1601. Lécluse traveled extensively in western Europe making collections, and wrote several books on the botany of the districts he visited. The figures of the potato plant in the work named are from drawings made by him in 1589 from actual specimens. The plant, we know, was growing in Italy in 1586, about which time it was also introduced into England.

Harvey's doctrine that every living thing came originally from an egg, afterwards expressed by the aphorism,' 'Omne vivum ex ovo,' is symbolized in the engraved title-page of the second edition of his 'Exercitationes de Generatione Animalium,' printed at The Hague in 1680. The original edition was issued in London in 1651.

Space will allow us only to mention briefly one or two other works in this extremely interesting exhibition. Note should be made of John Ray's greatest botanical work, the 'Historia Plantarum,' published at London in 1686, containing the description of some 6,900 plants in systematic order. The museum copy was the property of Sir Hans Sloane, and has

his manuscript notes, with the references to the places of the plants in his herbarium. Then there is a copy of the second edition of Robert Plot's 'Natural History of Oxfordshire' (Oxford, 1705), the first edition of which appeared in 1677. This work was the forerunner of the numerous 'County Histories' that have been subsequently issued.

Finally, attention may be drawn to the earliest figure and description of that flightless bird, the solitaire, in a book by the French traveler François Leguat, printed at London in 1708. The solitaire formerly inhabited the island of Rodriguez, and became extinct about the end of the eighteenth century.

STATISTICS OF EASTERN, STATE AND FOREIGN UNIVERSITIES.

IN an address before the University of Michigan, printed in the *Atlantic Monthly*, Dr. Henry S. Pritchett showed a table giving data in regard to six of the older private universities in the eastern states, six western state universities and six foreign universities, which is here reproduced:

OLDER PRIVATE UNIVERSITIES IN EASTERN STATES.

Name.	Date of Founding.	Number in Instructing Staff.	Number of Students 1904.	Annual Budget 1904.	Annual Cost to University Per Student.	Annual Cost to Student.
Harvard	1636	525	5,143	$1,572,540[1]	$306	$150
Columbia	1754	551	5,017	1,438,638	270	$150 to $250
Yale	1716	343	3,138	800,000	255	100 " 150
Pennsylvania	1791	325	2,838	685,000	241	150 " 200
Princeton	1756	109	1,374	460,863	335	150 " 160
Brown	1764	85	988	180,000	192	150
Total		1,938	18,498	$5.137.041		

WESTERN STATE UNIVERSITIES.

Michigan	1837	292	4,136	$746,000	$180	$10 to $45
Illinois	1868	402	3,594	800,000	223	free
Wisconsin	1848	227	3,342	700,000	209	free
Minnesota	1868	290	3,895	497,000[2]	128	$20 to $100
California	1868	283	3,400	945 000	279	free
Nebraska	1869	193	2,513	419,750	167	free
Total		1,687	20,880	$4.107,750		

FOREIGN UNIVERSITIES.

Berlin	1807	504	13,782	$880,500	$ 64	small fees
Leipsic	1409	216	4,253	716,000	170	" "
Paris	1100	420	12,985	934,000	72	" "
Vienna	1384	431	6,205	464,000	76	" "
Bonn	1818	177	2,970	361,000	123	" "
Edinburgh	1583	205	2,971	469,000	158	$10 to $20 a course.
Total		1,953	43,166	$3.824,500		

[1] Omitting $875,575 in special gifts.

[2] Omitting $400,000 for buildings.

THE EIGHTEENTH SEASON OF THE MARINE BIOLOGICAL LABORATORY. 1905.

THE regular season for investigators opened June 1 and continued through most of September. During this period there were in attendance 71 investigators, of whom 63 occupied private rooms with an average period of attendance of about six weeks to two months.

Students receiving instruction were in session from June 28 to August 9, and the total attendance was 57, a much smaller number than in the years previous to 1903, owing to the raising of the standard of admission at that time. The work of collection of material was again under the charge of the curator of

the supply department, Mr. G. M. Gray, who had eight assistants during the busiest part of the season. Each investigator was supplied with his material on demand and the service gave great satisfaction.

For some years the necessity of a larger steamer has been felt and this year the laboratory chartered the steamer *Genevieve,* about 100 feet over all. The range of collecting expeditions was thus increased very materially and the work facilitated in many other ways. Another welcome addition to the equipment was a gasoline launch assigned to the supply department.

In the fall of 1904 the laboratory renovated and remodelled the interior of the old stone building known as the 'candle factory' and equipped it with heating apparatus and running salt water. It now forms the headquarters of the supply department, and two investigators' rooms are available for use at all seasons of the year.

The annual meeting of the trustees and corporation was held on August 8. Reports of the assistant director and treasurer showed a very satisfactory condition of the laboratory as to equipment and finances. Messrs. S. F. Clark, Charles Coolidge, C. R. Crane, T. H. Morgan, L. L. Nunn, John C. Phillips, Erwin F. Smith and E. B. Wilson were reelected trustees to serve until 1909, and Messrs. A. P. Mathews and H. S. Jennings were elected to fill vacancies in the board. Seventeen new members were elected to the corporation.

The following is the list of investigators who worked at the laboratory during the season:

I. ZOOLOGY.

1. *Occupying Rooms.*

Budington, Robert A., instructor in zoology, Wesleyan University, Conn.

Clapp, Cornelia M., professor of zoology, Mt. Holyoke College, South Hadley, Mass.

Colton, Harold Sellers, graduate student, University of Pennsylvania, Philadelphia, Pa.

Conklin, E. G., professor of zoology, University of Pennsylvania, Philadelphia, Pa.

Drew, Gilman A., professor of biology, University of Maine, Orono, Me.

Fielde, Adele M., New York, N. Y.

Foot, Katherine, 80 Madison Ave., New York, N. Y.

Gardiner, E. G., 131 Mt. Vernon St., Boston, Mass.

Glaser, Otto Charles, instructor, University of Michigan, Ann Arbor, Mich.

Goldfarb, Abraham J., graduate student, Columbia University, New York, N. Y.

Hargitt, C. W., professor of zoology, Syracuse University, Syracuse, N. Y.

Hargitt, George Thomas, instructor in biology, Syracuse High School, Syracuse, N. Y.

Jennings, H. S., assistant professor of zoology, University of Pennsylvania, Philadelphia, Pa.

King, Helen Dean, graduate student, Bryn Mawr College, Bryn Mawr, Pa.

Lambert, Avery E., instructor in biology, State Normal School, Framingham, Mass.

Lefevre, George, professor of zoology, University of Missouri, Columbia, Mo.

Lewis, Warren Harmon, associate professor of anatomy, Johns Hopkins University, Baltimore, Md.

Lillie, Frank R., associate professor of embryology, University of Chicago, Chicago, Ill.

Loeb, Leo, assistant professor of experimental pathology, University of Pennsylvania, Philadelphia, Pa.

Lombard, Guy Davenport, assistant instructor in histology, Cornell University, Ithaca, N. Y.

Lommen, Christian P., professor of biology, University of South Dakota, Vermilion, South Dakota.

McClellan, John H., graduate student, Harvard College, Cambridge, Mass.

McGregor, James Howard, lecturer in vertebrate zoology, Columbia University, New York, N. Y.

Morgan, T. H., professor of experimental zoology, Columbia University, New York, N. Y.

Morgan, Mrs. T. H., New York, N. Y.

Murbach, Louis, head of department of biology, Central High School, Detroit, Mich.

Putnam, Margaret, student, Bryn Mawr College, Bryn Mawr, Pa.

Reed, Margaret, graduate student, Columbia University, New York, N. Y.

Retzer, Robert, assistant in anatomy, Johns Hopkins University, Baltimore, Md.

Richardson, Harriet, Washington, D. C.

Shippen, L. P., graduate student, University of Pennsylvania, Philadelphia, Pa.

Snowden, Louise Hortense, graduate student, University of Pennsylvania, Philadelphia, Pa.

Smith, Grant, teacher of biology, Chicago Normal School, Chicago, Ill.

Stevens, Nettie Maria, Bryn Mawr College, Bryn Mawr, Pa.

Strobell, Ella G., New York, N. Y.

Strong, Oliver S., instructor in histology, Columbia University, New York, N. Y.

Strong, R. M., associate in zoology, University of Chicago, Chicago, Ill.

Tennent, David Hilt, associate in biology, Bryn Mawr College, Bryn Mawr, Pa.

Treadwell, Aaron L., professor of biology, Vassar College, Poughkeepsie, N. Y.

Wallace, Louise Baird, associate professor of zoology, Mt. Holyoke College.

Whitney, David Day, graduate student, Columbia University, New York, N. Y.

Wilson, Edmund B., professor of zoology, Columbia University, New York, N. Y.

Woodruff, Lorande Loss, instructor in biology, Williams College, Williamstown, Mass.

II. OCCUPYING TABLES.

Allabach, Lulu F., department of zoology and geography, State Normal School, Lockhaven, Pa.

Buckingham, Edith N., Radcliffe College, Cambridge, Mass.

Gregory, Louise H., graduate student at Columbia University, New York, N. Y.

Newman, Horatio H., instructor in zoology, University of Michigan, Ann Arbor, Mich.

O'Neil, Elizabeth Breading, instructor, Mt. Holyoke College, South Hadley, Mass.

Surface, Frank Macy, fellow in zoology, University of Pennsylvania.

Terry, Oliver P., assistant in physiology, St. Louis University Medical Department, St. Louis, Mo.

Worsham, Ernest Lee, tutor in biology, University of Georgia, Athens, Ga.

2. *Physiology.*

Brown, Harry Orville, assistant professor of pharmacology, St. Louis University.

Carlson, Anton J., assistant professor of comparative physiology, University of Chicago, Chicago, Ill.

Hyde, Ida H., professor of physiology, University of Kansas, Lawrence, Kansas.

Lillie, Ralph S., instructor in physiology, Harvard Medical School, Boston, Mass.

Lyon, Elias Potter, professor of physiology, St. Louis University, St. Louis, Mo.

Mathews, A. P., associate professor of physiological chemistry, University of Chicago, Chicago, Ill.

Meigs, Edward B., assistant in physiology, University of Pennsylvania, Philadelphia, Pa.

Packard, Wales H., assistant professor of biology, Bradley Polytechnic Institute, Peoria, Ill.

Sollmann, Torald, professor of pharmacology, Western Reserve University Medical Department, Cleveland, Ohio.

Spaulding, Edward G., preceptor in philosophy, Princeton University, Princeton, N. J.

3. *Botany.*

Andrews, Frank Marion, assistant professor of botany, Indiana University, Bloomington, Ind.

Dacy, Alice Evelyn, South Boston, Mass.

Davis, Bradley Moore, assistant professor of botany, University of Chicago, Chicago, Ill.

MacRae, Lillian J., teacher, South Boston High School, South Boston, Mass.

Stickney, Malcolm E., assistant professor of botany, Denison University, Granville, Ohio.

Wolfe, Jas. J., adjunct professor of biology, Trinity College, Durham, N. C.

Wylie, Robert Bradford, professor of biology, Morning College, Sioux City, Iowa.

Yamanouchi, Shigeo, fellow of the University of Chicago, Chicago, Ill.

SUMMARY—1905.

Students.

Course in zoology	27	
Course in life histories	14	
Course in physiology	7	
Course in botany	9	
	—	57

Investigators.

Zoology:		
Occupying rooms	43	
Occupying tables	8	
	—	51
Physiology:		
Occupying rooms	10	
Occupying tables	2	
	—	12
Botany:		
Occupying rooms	8	
	—	8
Total of students and investigators	128	
Deduct two names mentioned twice	2	
	—	126

Number of Institutions Represented.

By investigators	35	
By students	36	
	—	71

Colleges, Universities and Institutions

Represented.

By investigators	28	
By students	26	
	—	54

Schools and Academies Represented.

By investigators	7	
By students	10	
	—	17

RESEARCH SEMINARS AT THE MARINE BIOLOGICAL LABORATORY. SEASON OF 1905.

July 11. Dr. A. J. Carlson, 'Conduction in Nerves.'

July 13. Dr. A. P. Mathews, 'Precipitation of Colloids by Electrolytes.'

July 18. Dr. L. L. Woodruff, 'Life-Histories of Hypotrichous Ciliates.'

July 20. Dr. W. H. Lewis, 'Experiments on Correlative Embryology.'

July 25. Dr. Torald Sollmann, 'Filtration Phenomena in Dead Kidneys.'

July 28. Dr. C. W. Hargitt, 'Variations in the Genus *Aurelia*.'

August 2. Dr. H. S. Jennings, 'Behavior of Sea Anemones.'

August 8. Dr. O. C. Glaser, 'Amitosis in *Fasciolaria* Embryos'; 'Origin of Nettle Cells in Nudibranchs.'

August 10. Dr. Leo Loeb, 'The Growth of Tumors.'

August 15. Dr. E. P. Lyon, 'Geotropism in *Paramœcium*.'

August 17. Dr. E. G. Spaulding, 'Experimental Determination of Energy in the Segmentation of the Sea-Urchin's Egg.'

August 22. Mr. J. F. McClendon, 'Some Effects of Pressure on the Segmentation of the Eggs of Copepods.'

Dr. Louis Murbach, 'Marginal Bodies of *Gonionemus*.'

Frank R. Lillie.

THE NEW ORLEANS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The permanent secretary of the association has received a certain number of letters from members who seem to have gained the impression that there is some doubt about the desirability of holding the meeting as announced in the city of New Orleans on account of the fact that there have been a number of cases of yellow fever in that city during the past few months. The permanent secretary has consulted members of the committee on the policy of the association and some of the leading members of the council and finds that the consensus of opinion is that the meeting should be held in New Orleans and that no change of plan should be considered. He has further corresponded with prominent yellow fever experts and sanitarians and has consulted the wishes of the people of New Orleans and the result is that it seems beyond all possible question that a meeting during convocation week in that city will be as safe as in any other city in the United States.

Surgeon-General Walter Wyman, of the Public Health and Marine Hospital Service, who has charge of the situation in New Orleans, assures the permanent secretary that there will not be the slightest danger in holding the meeting in New Orleans at the time specified. Such a thing as a case of yellow fever at that time is unprecedented and long before that time the last case will have received its final treatment.

Ex-Surgeon-General Sternberg, U. S. Army, a notable yellow fever expert, writes the permanent secretary under date of October 7, that the history of the prevalence of yellow fever in New Orleans makes it appear certain that there will be no danger to any one visiting that city at the time of the meeting of the American Association for the Advancement of Science, December 28, 1905.

President Craighead, of Tulane University, and the secretaries of the New Orleans Progressive Union, Board of Trade, Stock Exchange, Sugar and Rice Exchange, have all written letters voicing the same opinion and with enthusiastic cordiality renewing the invitation to the association to hold its meeting in New Orleans. It would have been a sore

disappointment to the people of New Orleans had the association expressed any strong doubt of the fulfillment of its promise to meet in that city.

Dr. J. H. White, in charge of the Public Health and Marine Hospital Service in New Orleans, states that it would be perfectly safe for the association to meet in New Orleans long prior to December 29.

The secretary of the New Orleans board of trade writes that the hospitality of the city will not in the least suffer from the occurrence of yellow fever during the summer, which has not been a strain on the financial resources of the community, since there was only a slight interruption in the free movement of business. He further makes the significant remark, under date of September 19:

> The advancement of science has taught our citizens a lesson how to guard against a recurrence of yellow fever and there is to-day less danger from that disease than from typhoid fever which at this time prevails in many eastern cities to an alarming extent.

He further says:

> The association could not meet in a city more hospitable, nor in a climate more salubrious and environments more pleasing. * * * The entertainments to be given will not be lacking in that enthusiasm and warmth for which our city is famous all over the United States. * * * The association will find that the outbreak of yellow fever has neither made us too poor, nor too sorrowful, to give a rousing reception to the American Association for the Advancement of Science.

A letter received September 25, from a prominent state scientific official, residing in Shreveport, who has recently gone to the state of Louisiana and is, therefore, not influenced by local pride, writes to the permanent secretary as a member of the association, expressing the opinion that not the slightest risk will be incurred by any member of the association and that the meeting could in fact be held in New Orleans at the date of writing (September 25) and the visitors would be in no more danger of contracting yellow fever than they would be in contracting smallpox in Chicago or typhoid fever in Washington or Philadelphia.

On the basis of these opinions and on the strength of his own opinion (and he has for some years been making a special study of the yellow fever mosquito) and by the advice of a majority of the committee on policy, the permanent secretary is now making arrangements for the meeting and will as soon as possible issue the preliminary announcement. The local arrangements have been delayed, but President Craighead, of Tulane University, has now returned to New Orleans and the committees will soon be appointed, so that the necessary details may be completed. An effort is being made to secure a one-fare rate for the round trip and the result of these negotiations as well as other facts will be published as soon as possible.

SCIENTIFIC NOTES AND NEWS.

THE exercises in connection with the installation of Dr. Edmund J. James, as president of the University of Illinois, on Tuesday, Wednesday and Thursday of last week, took place in accordance with the program already printed here, in the presence of a large assemblage of delegates from foreign and American universities. We hope to print in a subsequent issue the inaugural address of President James. Among the honorary degrees conferred were the following: Doctor of laws, Professor Thomas F. Holgate, acting-president of Northwestern University, and John B. Murphy, M.D., Chicago; doctor of science, Professor T. C. Chamberlin, of the University of Chicago; doctor of engineering, Octave Chanute, Chicago, and F. E. Turneaure, University of Wisconsin; doctor of

agriculture, Norman J. Colman, former secretary of agriculture, and Alvin H. Sanders, Chicago.

A scientific session of the National Academy of Sciences will be held at the Sheffield Scientific School, Yale University, New Haven, beginning Tuesday, November 14, 1905, at 11 A.M. A special stated session of the academy will be held on Wednesday, November 15, to consider any business that may come before the academy.

According to a despatch from Lindenburg, Prussia, where Emperor William went last week to attend the dedication of the Royal Prussian Aeronautical Observatory, the German ruler has conferred upon Mr. A. Lawrence Rotch, director of the Blue Hill Observatory the Order of the Red Eagle of the third class. The emperor at the same time presented the Prince of Monaco the great gold medal bestowed once a year for work in science.

Dr. Adolf von Baeyer, professor of chemistry at Munich, has been elected a foreign member of the Berlin Academy of Sciences. Dr. Baeyer will celebrate his seventieth birthday on October 31.

Dr. Hubert Lyman Clark, professor of biology at Olivet College, Michigan, who has recently been working with Dr. Alexander Agassiz in the study of sea urchins, will join the staff of the Harvard Museum of Comparative Zoology.

Mr. Percy W. Flint, of Charleston, S. C., has been appointed assistant chemist of the Pennsylvania Experiment Station in place of Mr. Arthur W. Clark, resigned.

The international Italian 'King Humbert Prize' of 2,500 francs for the most important contribution to orthopedic surgery has been assigned to Dr. Oscar Vulpius, of Heidelberg.

The Alvarenga prize for 1905 has been awarded to Dr. Chalmers Watson, of Edinburgh, Scotland, for his essay, entitled 'The Importance of Diet; an Experimental Study from a New Standpoint.' This prize is given by the College of Physicians of Philadelphia, and consists, each year, of the income of the bequest of the late Señor Alvarenga, amounting to about $180. The next award will be made July 14, 1906, provided that an essay deemed by the committee of award to be worthy of the prize shall have been offered. Essays intended for competition may be on any subject in medicine, but can not have been published. They must be typewritten, and must be received by the secretary of the college on or before May 1, 1906.

Sir Clements R. Markham, F.R.S., gave an address at Cambridge on October 19, introductory to the courses of instruction in geography.

The sixth annual Huxley memorial lecture of the Anthropological Institute, London, will be delivered on October 31, by Dr. John Beddoe, F.R.S., the subject being 'Color and Race.'

The three-hundredth anniversary of the birth of Sir Thomas Browne was celebrated by Yale University on October 19 with a commemorative address by Dr. Francis Bacon, under the auspices of the Modern Language Club.

Dr. Walter F. Wislicenus, editor-in-chief of the *Astronomischer Jahresbericht*, died on October 3 after a very brief illness. He was born November 5, 1859; was a member of the German transit of Venus expedition in 1882; assistant in the observatory of the University of Strassburg, 1883–89; instructor in the university since 1887, and professor since 1894. Since 1899, he has edited six volumes of the *Astronomischer Jahresbericht*, aggregating 3,764 octavo pages, embracing reviews of 13,874 separate books or articles.

Nature announces the deaths of the Rev. S. J. Johnson, the author of contributions to astronomy, and of Sir Edward H. Carbutt, a mechanical engineer.

The Boston *Transcript* estimates that the William M. Rice Institute for the Advancement of Literature, Science and Art, of Houston, Tex., organized to take under his will the residuary estate of William M. Rice, will receive from Rice's property in New York state $2,177,361.92. Since the murder of Mr. Rice his estate has been in litigation both in

New York and in Texas, a dispute over the probate of one will having been brought into court on the charge that the signature to it was a forgery. A controversy also arose on a claim against the estate for $2,000,000 by the executors of the estate of the wife, Elizabeth B. Rice. This was settled by the payment of $200,000. Nearly a million dollars have been paid in lawyers' fees and expenses incidental to the administration of the estate.

THE department of anthropology, of the American Museum of Natural History, has received as a gift from Mr. T. Van Hyning, of the State Historical Department of Des Moines, Iowa, a series of grooved axes, celts and stone disks.

MR. L. H. FARLOW has recently presented the Peabody Museum with a large and rare collection of relics of Indian manufacture, collected on the northern Pacific coast—from Alaska to northern California.

Nature states that the Municipal Museum, at Hull, has recently acquired a valuable addition to its collection of local Roman and other remains. The specimens are principally of Roman date, and include more than 2,000 coins, nearly 100 fibulæ of a great variety of patterns, several dozen buckets, pins, dress fasteners, ornaments, strap ends, bosses, spindle whorls, armlets, spoons, beads and other objects. Among the fibulæ are two of exceptional interest, as they bear the maker's name upon them (Avcissa). There is also an extensive collection of pottery, including many vases, strainers, dishes, etc., in grey ware, as well as many fine pieces of Samian ware, several of which contain the potters' marks.

WE learn from the *Boston Transcript* that the annual meeting of the Teachers' School of Science was held at the Twentieth Century Club, Boston, on October 20. Addresses were made by Henry L. Clapp, of the Putnam School; Arthur C. Boyden, of the Bridgewater Normal School; Mrs. Caroline F. Cutler, of the Wyman School, Jamaica Plain; and Miss Annette M. Blount, of the Wellesley Schools. The following officers were elected: President, Professor George H. Barton; first vice-president, Professor A. Lawrence Lowell; second vice-president, Miss Mary C. Mellyn; third vice-president, Miss Mary F. Thompson; auditor, Mr. Seth Sears; secretary and treasurer, Miss Cora S. Cobb.

MEDICAL journals report that the second International Sanitary Conference of American Republics was held in Washington, D. C., beginning on October 10. Delegates from twelve South American republics, from the army and navy and from the United States Health and Marine Hospital Service were in attendance. Surgeon General Walter Wyman presided. The address of welcome on behalf of the government was made by Mr. Root, the secretary of state. Mr. Taylor, assistant secretary of the treasury, also welcomed the delegates on behalf of the Public Health and Marine Hospital Service. The response was made by Mr. Quesada, the Cuban minister.

IT is reported that Dr. Max Reithoffer, professor at the Vienna Technical High School, has, jointly with the court watchmaker, Karl Morawetz, submitted to the common council of Vienna a plan for an electric system of clocks run by wireless electricity. They propose to furnish the chronometric and electric apparatuses, including clocks, to the city free of charge, and to make the trials. The city has only to furnish the current, the cable connections, etc., and give the use of suitable buildings. The common council has appropriated $600 for making experiments.

UNIVERSITY AND EDUCATIONAL NEWS.

MR. ANDREW CARNEGIE has offered $100,000 to Union College, for an engineering building, on condition that the institution raise a like amount for this purpose. Mr. Carnegie has also offered to give Smith College one half of $125,000 required for a biological laboratory.

BUILDING A, the first of the initial group of seven structures that form the new Carnegie Technical Schools, in Pittsburg, Pa., has been opened with a class of 120 students, selected from more than six hundred applicants. The classes will be increased from time to time as the buildings are opened. The schools for apprentices and journeymen are to be opened next month, and the other mechanical depart-

ments are being pushed forward to early completion.

THE *Boston Transcript* reports that the total enrolment of students in Harvard University, not including Radcliffe College and the Summer School, reckoned from October 7, is 3,865, as against 4,004 at a corresponding time last year. In Harvard College there are 1,896 students, which is 93 less than on October 7 last year. In the Lawrence Scientific School are registered 500, a decrease of 14. The Graduate School shows 364, an increase of 21, and the Bussey Institution has enlarged its numbers from 22 to 27, but these are the only two departments of the university in which there has not been a loss. In the Divinity School there are 34, a loss of 3; in the Law School 681, a loss of 24; in the Medical School 281, a loss of 8; and in the Dental School 82, which is 23 less than last year on the above date. It might be mentioned in connection with the Medical School that the entering class has 10 more students than in 1904, the first increase since a degree was required for admission.

REGISTRATION figures complete to October 20, for all departments of Cornell University, at Ithaca, are, according to the New York *Evening Post* as follows:

	1904.	1905.
Sibley College	1,040	1,078
Arts	648	693
Civil engineering	377	411
Law	213	219
Agriculture	178	216
Veterinary	104	88
Architecture	68	79
Medicine	82	57
Graduates	147	151
Total	2,857	2,992

THE president of Tulane University announces the proposal to found a school of tropical medicine in connection with that institution.

AT the last meeting of the corporation of Harvard University, as reported in the Boston *Transcript,* the resignations of the following instructors were accepted: A. B. Plowman, '02, instructor in botany; H. W. Hill, instructor in bacteriology; P. Hodge, assistant in physics, and A. K. Adams, '04, assistant in geology. Appointments were made for one year, as follows: L. D. Hill, '94, and E. R. Shepard, assistants in physics; M. R. Cohen, assistant in philosophy; R. Kent, assistant in geology; E. C. Froelich, '03, and H. N. Davis, '03, instructors in mathematics; A. C. Boylston, '03, R. F. Jackson, '03, B. S. Lucy, J. E. Zanetti, '06, C. M. Brewster, W. V. Green, W. C. Holmes, E. Mueller, G. N. Terzieff and L. H. Whitney, assistants in chemistry; G. S. Forbes, '02, lecturer on physical chemistry; J. G. Jack and D. A. Clarke, '04, instructors in forest botany; R. C. Hawley, instructor in forestry; H. N. Eaton, assistant in geology, and E. J. Sanders, assistant in meteorology and physiography.

THE University of Maine opened on September 20 with 190 additions to its collegiate departments. Of these about 120 are regular freshmen. The following appointments have been made in the various scientific departments: J. S. Stevens, professor of physics, dean of the College of Liberal Arts; W. K. Ganong, acting professor of electrical engineering; A. C. Jewett, associate professor of mechanical engineering; G. E. Tower, professor of forestry; M. H. Bedford, instructor in chemistry; W. R. Ham, instructor in physics; T. M. Gunn, instructor in mechanical engineering; H. D. Carpenter, instructor in electrical engineering; A. W. Gilbert, instructor in agriculture; J. M. Bearce, tutor in physics; L. T. Ernst, assistant in horticulture; M. G. Leeds, assistant in the experiment station.

MR. JAMES H. JEAMS, lecturer at Cambridge, has been made professor of applied mathematics at Princeton University.

DR. GEORGE BEN JOHNSTON, of the Medical College of Virginia, has been elected professor of surgery at the University of Virginia to succeed Dr. A. H. Buckmaster, resigned.

DR. JOHN EARNEST LONCING, Harvard, takes the chair in chemistry at Hobart College, Geneva, N. Y., in place of Dr. Herbert Raymond Moody, who has gone to the College of the City of New York.